AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (withdrawn) A range finder for measuring a three-dimensional position of a subject by projecting light on said subject and receiving reflected light, comprising:

a light source array unit in which a plurality of light sources are arranged; and

a light source control unit for allowing at least two kinds of light patterns to be projected from said light source array unit by controlling a light emitting state of each of said plurality of light sources of said light source array unit.

2. (withdrawn) The range finder of Claim 1,

wherein each of said plurality of light sources in an LED.

3. (withdrawn) The range finder of Claim 1,

wherein said plurality of light sources are arranged in a lattice pattern or a checkered pattern in said light source array unit.

4. (withdrawn) The range finder of Claim 1,

wherein said plurality of light sources are arranged on a curved surface in said light source array unit.

5. (withdrawn) The range finder of Claim 1,

wherein said plurality of light sources are arranged on a flat surface with optical axes thereof radially disposed in said light source array unit.

6. (withdrawn) The range finder of Claim 1,

wherein in said light source array unit, a projection range is divided into a plurality of ranges in a direction for forming said light patterns, and groups of light sources respectively covering said divided ranges are alighted along a direction perpendicular to the direction for forming said light patterns.

7. (withdrawn) The range finder of Claim 1,

wherein said light source control unit generates said light patterns by controlling emission intensities of said plurality of light sources in accordance with positions thereof.

8. (withdrawn) The range finder of Claim 1,

wherein said light source control unit generates said light patterns by controlling emission times of said plurality of light sources in accordance with positions thereof.

9. (withdrawn) The range finder of Claim 7 or 8,

wherein said light source control unit modifies said emission intensities or said emission times of light sources disposed in the vicinity of an edge of said light source array unit for enlarging a spatial range where the three-dimensional position is able to be measured in projecting said two kinds of light patterns.

10. (withdrawn) The range finder of Claim 1,

wherein said light source array unit is plural in number, and

said plural light source array units are arranged with light projection directions thereof different from each other.

11. (withdrawn) The range finder of Claim 1, further comprising a three-dimensional measurement unit for carrying out three-dimensional measurement on the basis of reflected light images,

wherein said three-dimensional measurement unit stores, before the three-dimensional measurement, a parameter of an equation for approximating a space locus having a constant light intensity ratio between said two kinds of light patterns projected from said light source array unit; obtains a brightness ratio of a target pixel on the basis of reflected light images respectively obtained with said two kinds of light patterns projected; and carries out the three-dimensional measurement by using said brightness ratio of said target pixel and said parameter of the space locus.

12. (withdrawn) The range finder of Claim 1, further comprising a three-dimensional measurement unit for carrying out three-dimensional measurement on the basis of reflected light images,

wherein said three-dimensional measurement unit stores, before the three-dimensional measurement, a plurality of luminance ratio images in each of which a light intensity ratio between said two kinds of light patterns projected from said light source array unit is expressed on a plane with a different fixed depth value; obtains a brightness ratio of a target pixel based on reflected light images respectively obtained with said two kinds of light patterns projected; and carries out the three-dimensional

measurement by comparing said brightness ratio of said target pixel with a light intensity ratio in the vicinity of coordinates of said target pixel in each of said luminance ratio images.

13. (withdrawn) The range finder of Claim 1 further comprising a three-dimensional measurement unit for carrying out three-dimensional measurement on the basis of reflected light images,

wherein said three-dimensional measurement unit stores, before the three-dimensional measurement, a plurality of luminance ratio images in each of which a light intensity ratio between said two kinds of light patterns projected from said light source array unit is expressed on a plane with a different fixed depth value; sets representative points in each of said plurality of luminance ratio images and determines a parameter of a relational expression between a light intensity ratio and a depth value of each of said representative points on the basis of said plurality of luminance ratio images and said different depth values corresponding to said luminance ratio images; obtains a light intensity ratio of a target pixel based on reflected light images respectively obtained with said two kinds of light patterns projected; and carries out the three-dimensional measurement by using coordinate values of said target pixel, said light intensity ratio of said target pixel and said parameter of said relational expression between the light intensity ratio and the depth value of each of said representative points.

14. (withdrawn) A method for measuring a three-dimensional position of a subject based on reflected light images respectively obtained with at least two kinds of light patterns projected on said subject, comprising the steps of:

storing a parameter of an equation for approximating a space locus having a constant light intensity ratio between said two kinds of light patterns before three-dimensional measurement;

obtaining a brightness ratio of a target pixel on the basis of reflected light images respectively obtained with said two kinds of light patterns projected; and

carrying out the three-dimensional measurement by using said brightness ratio of said target pixel and said parameter of the space locus.

15. (withdrawn) A method for measuring a three-dimensional position of a subject based on reflected light images respectively obtained with at least two kinds of light patterns projected on said subject, comprising the steps of:

storing a plurality of luminance ratio images in each of which a light intensity ratio between said two kinds of light patterns is expressed on a plane with a different fixed depth value before three-dimensional measurement;

obtaining a brightness ratio of a target pixel based on reflected light images respectively obtained with said two kinds of light patterns projected; and

carrying out the three-dimensional measurement by comparing said brightness ratio of said target pixel with a light intensity ratio in the vicinity of coordinates of said target pixel on each of said luminance ratio images.

16. (withdrawn) A method for measuring a three-dimensional position of a subjected based on reflected light images respectively obtained with at least two kinds of light patterns projected on said subject, comprising the steps of:

storing a plurality of luminance ratio images in each of which a light intensity ratio between said two kinds of light patterns is expressed on a plane with a different fixed depth value before three-dimensional measurement;

setting representative points on each of said luminance ratio images and determining a parameter of a relational expression between a light intensity ratio and a depth value of each of said representative points on the basis of said plurality of luminance ratio images and said different depth values respectively corresponding to said luminance ratio images;

obtaining a light intensity ratio of a target pixel based on reflected light images respectively obtained with said two kinds of light patterns projected; and

carrying out the three-dimensional measurement by using coordinate values of said target pixel, said light intensity ratio of said target pixel and said parameter of said relational expression between the light intensity ratio and the depth value of each of said representative points.

17. (withdrawn) A range finder for measuring a three-dimensional position of a subject by projecting light on said subject and receiving reflected light, comprising:

a projection unit for projecting at least two kinds of light patterns; and

a projected light pattern control unit for making a measurement range or measurement accuracy variable by changing a set of light patterns to be projected from said projection unit.

18. (withdrawn) The range finder of Claim 17,

wherein said projection unit includes:

a light source array unit in which a plurality of light sources are arranged; and

a light source control unit for allowing said light source array unit to project a set of light patterns by controlling a light emitting state of each of said plurality of light sources of said light source array unit, and

said projected light pattern control unit instructs said light source control unit about a kind of set of light patterns to be projected from said light source array unit.

19. (withdrawn) The range finder of Claim 17,

wherein said projected light pattern control unit has a general measurement mode for projecting a first set of light patterns having a general projection range and an accurate measurement mode for projecting a second set of light patterns having a smaller projection range than said first set of light patterns into plural directions.

20. (withdrawn) The range finder of Claim 17,

wherein said projected light pattern control unit has a measurement mode in which a first set of light patterns having a relatively large projection range is projected at an initial stage of measurement and a second set of light patterns having a relatively small projection range is subsequently projected in a specific region of said relatively large projection range.

21. (currently amended) A light source apparatus comprising a plurality of light sources arranged therein, being operable to project a desired light pattern according to control of a light emitting state of each of said plurality of light sources by a light source controller,

wherein said plurality of light sources are arranged in an array on a flat surface with optical axes thereof disposed radially toward an object, having linear groups aligned in parallel, and

said optical axes of light sources in [[a]] each said linear group are radially disposed outward in a common plane, and

intensity of said light sources increases or decreases ~~monotonously~~ monotonically in a linear group.

22. (currently amended) A light source apparatus comprising a plurality of light sources arranged therein, being operable to project a desired light pattern according to control of a light emitting state of each of said plurality of light sources by a light source controller,

wherein a projection range is divided into a plurality of ranges in a direction for forming said light pattern, and

groups of light sources respectively covering said plurality of divided ranges, being linear groups aligned in parallel, are aligned in a direction perpendicular to said direction for forming said light pattern, and

intensity of said light sources increases or decreases ~~monotonously~~ monotonically in each said divided range in one direction.

23-24. (cancelled)